USDA FOREST SERVICE
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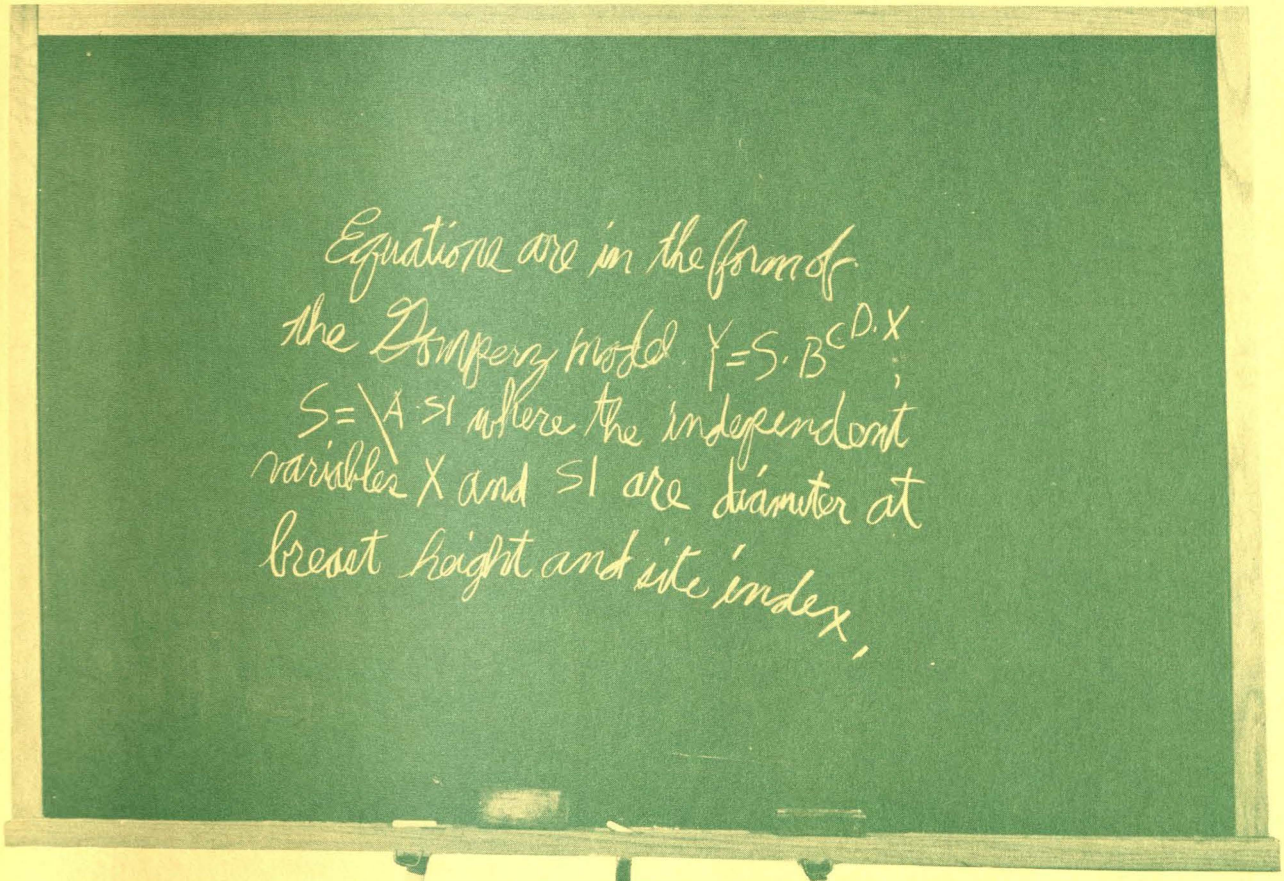
# local net volume equations for missouri


Equations are in the form of
the Dunpery model. $Y=S \cdot B^{C D \cdot X}$;
$S=A \cdot SI$ where the independent
variables X and SI are diameter at
breast height and site index,

by jerold t. hahn

NORTH CENTRAL FOREST EXPERIMENT STATION
FOREST SERVICE
U.S. DEPARTMENT OF AGRICULTURE

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# LOCAL NET VOLUME EQUATIONS FOR MISSOURI

Jerold T. Hahn

## APPLICATION

As a part of the 1972 Forest Survey of Missouri, personnel of the Station's Forest Survey Team developed a merchantable tree volume equation and tables of coefficients for four regions of Missouri. This equation and the coefficients can be used on a digital computer by industrial foresters, consulting foresters, or others in need of quick net-volume-per-tree estimates. The equation and coefficients were developed for both board foot (International ¼-inch rule) and cubic foot volumes, for several species and species groups, and for two tree classes, "desirable" and "acceptable."[1]

The only data needed to determine tree volumes in Missouri with the equation and coefficients are species, d.b.h., tree class, and site index.[2]

To use the equation and coefficients, find on the map the region in Missouri where the trees grow (fig. 1). Next, decide whether you want cubic or board foot volume, and decide what tree class (desirable or acceptable) the trees fall into. Then choose the appropriate table (tables 1 to 4), and the proper region (Survey Unit) within it.

Columns 1 through 6 in the tables contain all the information needed for using the equation except d.b.h. The coefficients (columns 2 through 5) to be substituted in the equation depend on the species group number (column 1), so first obtain this number from table 5. Then substitute in the following equation the appropriate coefficient A (column 2), site index (column 6 if site index was not measured in the field), coefficient B (column 3), coefficient C (column 4), coefficient D (column 5), and d.b.h.

$$\text{Volume} = (A \cdot \text{site index}) \cdot B^{C^{D \cdot DBH}}$$

[1] *Forest Survey classifies live trees as "desirable," "acceptable," "rough," "rotten," or "short-log." Equations were prepared for the first two classes. Forest Survey defines "desirable" trees as live trees that have no serious defects that limit present or prospective use and that have relatively high vigor and contain no pathogens that may result in death or serious deterioration before rotation age. These are trees that would be favored by forest managers in silvicultural operations. "Acceptable" trees are live trees having no serious defects that limit present or prospective use but that have pathogens or damage that may affect quality. The great majority of the trees in Missouri were classed as "acceptable" with very few "desirable" so the forester wishing to use only one equation for woods-run material would be best advised to use the equation for "acceptable" trees.*

[2] *If site index measurements have not been taken, the average site index for the observations used in constructing tables 1 to 4 can be used. These average site indexes are found in column 6 of the tables.*

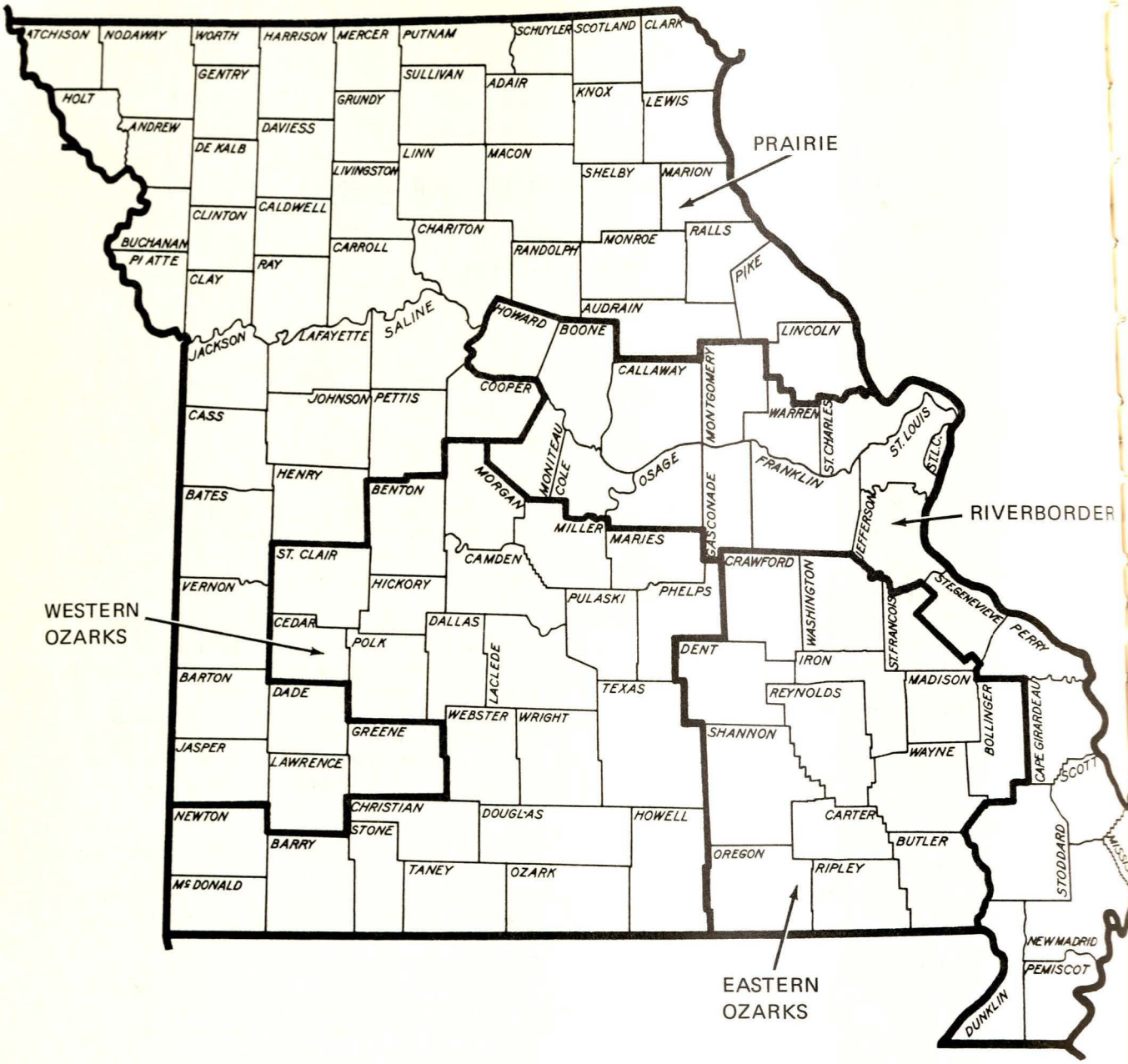


Figure 1.--*Regions of Missouri (Forest Survey Units) for which separate sets of equations were derived.*

Table 1.--*Cubic foot volume regression coefficients for desirable trees, Missouri, 1972*

| Species group number (1)[1] | Coefficient A (2) | B (3) | C (4) | D (5) | Average site index (6) | Observations (7) | Sampling error (8) | $R^2$ (9) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | No. | Cu. ft. | |
| **EASTERN OZARKS UNIT** | | | | | | | | |
| 1- 5 | 11.70 | 0.00076 | 1.42 | -0.15 | 58 | 67 | 4.17 | 0.89 |
| 6- 7 | 1.24 | .00081 | 1.62 | - .27 | 60 | 118 | 2.87 | .91 |
| 8-10 | 10.16 | .00090 | 1.38 | - .16 | 63 | 279 | 3.95 | .87 |
| 11-12 | 1.96 | .00124 | 1.58 | - .21 | 69 | 32 | 2.68 | .92 |
| 13-28 | 2.50 | .00055 | 1.59 | - .22 | 72 | 25 | 4.12 | .94 |
| **WESTERN OZARKS UNIT** | | | | | | | | |
| 1- 5 | 7.42 | 0.00149 | 1.41 | -0.17 | 57 | 12 | 3.87 | 0.89 |
| 6 | 1.24 | .00074 | 1.64 | - .26 | 59 | 42 | 4.56 | .82 |
| 7 | 4.35 | .00092 | 1.48 | - .19 | 54 | 25 | 3.60 | .90 |
| 8-10 | 1.63 | .00137 | 1.58 | - .23 | 64 | 85 | 3.87 | .90 |
| 11-12 | 2.79 | .00294 | 1.49 | - .20 | 61 | 15 | 4.64 | .87 |
| 13-27 | 9.28 | .00259 | 1.36 | - .15 | 69 | 31 | 6.68 | .95 |
| **PRAIRIE UNIT** | | | | | | | | |
| 6-12 | 5.53 | 0.0042 | 1.37 | -0.16 | 61 | 39 | 12.50 | 0.86 |
| 13-27 | 7.57 | .0009 | 1.35 | - .18 | 80 | 41 | 10.45 | .84 |
| **RIVERBORDER AND BOTTOMLANDS UNITS** | | | | | | | | |
| 1- 5 | 3.50 | 0.00033 | 1.48 | -0.19 | 79 | 29 | 7.25 | 0.98 |
| 6- 7 | 3.30 | .00465 | 1.46 | - .19 | 51 | 145 | 6.15 | .84 |
| 8-10 | 28.25 | .00052 | 1.31 | - .15 | 57 | 76 | 8.38 | .92 |
| 11-12 | 1.54 | .00086 | 1.63 | - .24 | 65 | 36 | 6.92 | .88 |
| 13-26 | 9.64 | .00080 | 1.42 | - .15 | 81 | 78 | 7.83 | .92 |

[1]Numbers in parentheses are the column numbers.

Table 2.--*Board foot volume regression coefficients for desirable trees, Missouri, 1972*

| Species group number (1)[1] | Coefficient A (2) | B (3) | C (4) | D (5) | Average site index (6) | Observations (7) | Sampling error (8) | $R^2$ (9) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | No. | Bd. ft. | |
| **EASTERN OZARKS UNIT** | | | | | | | | |
| 1- 5 | 168.15 | 0.00021 | 1.23 | -0.23 | 59 | 53 | 31.83 | 0.84 |
| 6- 7 | 10.49 | .00118 | 1.36 | - .34 | 61 | 53 | 24.32 | .78 |
| 8-10 | 123.30 | .00038 | 1.23 | - .23 | 64 | 174 | 29.74 | .76 |
| 11-12 | 31.05 | .00040 | 1.29 | - .29 | 72 | 20 | 20.68 | .87 |
| 13-27 | 12.00 | .00006 | 1.40 | - .37 | 74 | 16 | 36.12 | .84 |
| **WESTERN OZARKS UNIT** | | | | | | | | |
| 1- 5 | 261.90 | 0.00029 | 1.26 | -0.17 | 59 | 10 | 19.14 | 0.94 |
| 6- 7 | 4.00 | .00005 | 1.70 | - .40 | 55 | 37 | 27.25 | .65 |
| 8-10 | 10.06 | .00090 | 1.46 | - .28 | 64 | 54 | 28.74 | .82 |
| 11-12 | 5.07 | .00024 | 1.60 | - .35 | 65 | 11 | 32.30 | .73 |
| 13-27 | 39.20 | .00073 | 1.34 | - .21 | 72 | 23 | 48.90 | .94 |
| **PRAIRIE UNIT** | | | | | | | | |
| 6-12 | 162.77 | 0.0012 | 1.18 | -0.18 | 63 | 30 | 103.18 | 0.73 |
| 13-27 | 232.56 | .0002 | 1.20 | - .20 | 80 | 37 | 67.94 | .93 |
| **RIVERBORDER AND BOTTOMLANDS UNITS** | | | | | | | | |
| 1- 5 | 10.55 | 0.00002 | 1.56 | -0.24 | 90 | 15 | 61.18 | 0.94 |
| 6- 7 | 14.70 | .00578 | 1.31 | - .29 | 52 | 111 | 38.38 | .75 |
| 8-10 | 120.13 | .00078 | 1.22 | - .22 | 57 | 61 | 51.53 | .90 |
| 11-12 | 11.09 | .00040 | 1.32 | - .41 | 68 | 21 | 32.30 | .53 |
| 13-27 | 48.35 | .00031 | 1.31 | - .23 | 82 | 75 | 90.23 | .88 |

[1]Numbers in parentheses are the column numbers.

Table 3.--*Cubic foot volume regression coefficients for acceptable trees, Missouri, 1972*

| Species group number (1)[1] | Coefficient A (2) | B (3) | C (4) | D (5) | Average site index (6) | Observations (7) | Sampling error (8) | $R^2$ (9) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | No. | Cu. ft. | |
| **EASTERN OZARKS UNIT** | | | | | | | | |
| 1- 5 | 1.89 | 0.00085 | 1.56 | -0.23 | 60 | 597 | 1.92 | 0.93 |
| 6 | 23.38 | .00065 | 1.34 | - .12 | 60 | 955 | 4.75 | .86 |
| 7 | 1.47 | .00261 | 1.51 | - .22 | 55 | 382 | 2.58 | .90 |
| 8 | 18.91 | .00095 | 1.34 | - .13 | 60 | 84 | 6.89 | .84 |
| 9 | 1.41 | .00077 | 1.58 | - .25 | 63 | 1,555 | 5.74 | .79 |
| 10 | 1.16 | .00144 | 1.61 | - .24 | 56 | 67 | 2.02 | .93 |
| 11 | 1.49 | .00038 | 1.62 | - .25 | 63 | 144 | 2.52 | .89 |
| 12 | .86 | .00038 | 1.73 | - .27 | 60 | 240 | 2.80 | .86 |
| 13-23 | 32.35 | .00019 | 1.34 | - .14 | 73 | 107 | 11.20 | .90 |
| 24-25 | 1.37 | .00216 | 1.56 | - .22 | 65 | 44 | 3.09 | .88 |
| 26-27 | 4.19 | .00075 | 1.45 | - .19 | 64 | 83 | 3.23 | .89 |
| **WESTERN OZARKS UNIT** | | | | | | | | |
| 1 | 4.99 | 0.00071 | 1.47 | -0.19 | 58 | 216 | 2.50 | 0.89 |
| 4 | 21.11 | .00022 | 1.39 | - .16 | 43 | 40 | 1.24 | .68 |
| 6 | 1.34 | .00092 | 1.62 | - .24 | 57 | 530 | 4.02 | .86 |
| 7 | 1.45 | .00183 | 1.57 | - .22 | 52 | 569 | 3.14 | .84 |
| 8 | 13.50 | .00046 | 1.38 | - .16 | 58 | 95 | 4.28 | .95 |
| 9 | 3.41 | .00189 | 1.45 | - .18 | 61 | 862 | 5.60 | .87 |
| 10 | 2.54 | .00155 | 1.48 | - .20 | 56 | 94 | 3.85 | .93 |
| 11 | 3.65 | .00154 | 1.44 | - .18 | 65 | 78 | 3.05 | .95 |
| 12 | 2.22 | .00092 | 1.54 | - .21 | 55 | 139 | 2.18 | .94 |
| 13-17 | 1.17 | .00054 | 1.66 | - .25 | 68 | 29 | 3.83 | .88 |
| 18-21 | 18.74 | .00070 | 1.33 | - .14 | 67 | 50 | 6.07 | .95 |
| 22-25 | 3.61 | .00149 | 1.44 | - .18 | 65 | 63 | 3.13 | .96 |
| 26-27 | 14.33 | .00042 | 1.36 | - .15 | 58 | 34 | 3.54 | .78 |
| **PRAIRIE UNIT** | | | | | | | | |
| 1- 5 | 1.27 | 0.0013 | 1.78 | -0.21 | 72 | -- | -- | -- |
| 6 | 2.12 | .0028 | 1.56 | - .18 | 56 | 361 | 6.57 | 0.86 |
| 7 | .81 | .0009 | 1.69 | - .28 | 52 | 71 | 2.71 | .85 |
| 8 | 2.54 | .0005 | 1.58 | - .20 | 59 | 42 | 5.98 | .95 |
| 9 | 4.33 | .0011 | 1.33 | - .24 | 53 | 137 | 3.30 | .96 |
| 10 | 4.32 | .0007 | 1.44 | - .18 | 76 | 96 | 6.68 | .93 |
| 11 | 1.12 | .0022 | 1.57 | - .23 | 66 | 104 | 3.64 | .88 |
| 12 | 1.16 | .0021 | 1.58 | - .22 | 64 | 51 | 1.37 | .76 |
| 13-14 | 3.82 | .0013 | 1.45 | - .18 | 78 | 69 | 8.01 | .95 |
| 15-17 | -- | -- | -- | -- | -- | -- | -- | -- |
| 18 | 1.83 | .0005 | 1.59 | - .22 | 70 | 66 | 3.45 | .93 |
| 19 | 44.09 | .0002 | 1.31 | - .13 | 75 | 34 | 14.90 | .96 |
| 20 | 19.57 | .0009 | 1.32 | - .13 | 81 | 48 | 6.54 | .98 |
| 21-23 | 5.10 | .0009 | 1.42 | - .17 | 83 | 43 | 4.53 | .99 |
| 24-25 | .84 | .0008 | 1.67 | - .25 | 66 | 91 | 2.91 | .90 |
| 26 | 10.84 | .0006 | 1.35 | - .15 | 71 | 66 | 6.11 | .94 |
| 27 | 1.65 | .0010 | 1.53 | - .22 | 65 | 68 | 5.41 | .86 |
| **RIVERBORDER AND BOTTOMLANDS UNITS** | | | | | | | | |
| 1- 3 | 3.50 | 0.00033 | 1.48 | -0.19 | 79 | 29 | 7.25 | 0.98 |
| 4 | 1.27 | .00133 | 1.79 | - .21 | 41 | 129 | 1.47 | .88 |
| 6 | 1.69 | .00160 | 1.59 | - .23 | 49 | 1,124 | 5.65 | .80 |
| 7 | 2.93 | .00257 | 1.48 | - .19 | 43 | 437 | 3.38 | .84 |
| 8 | 3.56 | .0095 | 1.49 | - .20 | 54 | 196 | 9.34 | .87 |
| 9 | 6.76 | .00136 | 1.41 | - .16 | 58 | 439 | 6.29 | .91 |
| 10 | 4.74 | .00108 | 1.51 | - .15 | 60 | 52 | 3.51 | .98 |
| 11 | 4.13 | .00113 | 1.46 | - .19 | 58 | 193 | 5.09 | .97 |
| 12 | 5.09 | .00094 | 1.45 | - .19 | 56 | 142 | 3.33 | .95 |
| 13-15 | 5.21 | .00290 | 1.37 | - .16 | 59 | 85 | 3.48 | .94 |
| 16-17 | .53 | .00126 | 1.55 | - .36 | 73 | 37 | 5.18 | .79 |
| 18 | 44.36 | .00037 | 1.31 | - .12 | 64 | 120 | 7.65 | .92 |
| 19 | 7.97 | .00006 | 1.56 | - .16 | 78 | 59 | 13.15 | .92 |
| 20-21 | 9.53 | .00045 | 1.47 | - .15 | 92 | 96 | 16.84 | .98 |
| 22-25 | .73 | .00045 | 1.68 | - .30 | 64 | 78 | 4.58 | .76 |
| 26 | 25.84 | .00029 | 1.28 | - .14 | 68 | 98 | 9.41 | .97 |
| 27 | 1.43 | .00009 | 1.82 | - .22 | 86 | 243 | 5.81 | .89 |

[1]Numbers in parentheses are the column numbers.

Table 4.--*Board foot volume regression coefficients for acceptable trees, Missouri, 1972*

| Species group number (1)[1] | Coefficient A (2) | B (3) | C (4) | D (5) | Average site index (6) | Observations (7) | Sampling error (8) | $R^2$ (9) |
|---|---|---|---|---|---|---|---|---|
| | | | | | | No. | Bd. ft. | |
| **EASTERN OZARKS UNIT** | | | | | | | | |
| 1- 5 | 18.73 | 0.00069 | 1.38 | -0.26 | 61 | 301 | 14.74 | 0.90 |
| 6 | 83.50 | .00160 | 1.19 | - .19 | 61 | 336 | 40.43 | .68 |
| 7 | 40.86 | .00331 | 1.20 | - .20 | 58 | 122 | 26.01 | .71 |
| 8-10 | 6.14 | .00063 | 1.46 | - .32 | 63 | 691 | 48.62 | .55 |
| 11-12 | 11.76 | .00794 | 1.27 | - .27 | 61 | 103 | 29.10 | .32 |
| 13-27 | 18.16 | .00032 | 1.21 | - .41 | 73 | 75 | 35.44 | .79 |
| **WESTERN OZARKS UNIT** | | | | | | | | |
| 1- 5 | 42.61 | 0.00042 | 1.36 | -0.23 | 59 | 109 | 19.91 | 0.84 |
| 6 | 7.54 | .00082 | 1.47 | - .28 | 57 | 249 | 33.58 | .64 |
| 7 | 22.29 | .00322 | 1.31 | - .20 | 52 | 206 | 25.91 | .56 |
| 8 | 38.18 | .00102 | 1.32 | - .20 | 60 | 50 | 49.18 | .80 |
| 9 | 10.53 | .00191 | 1.39 | - .25 | 60 | 395 | 48.27 | .68 |
| 10 | 9.90 | .00112 | 1.42 | - .26 | 60 | 24 | 44.93 | .85 |
| 11 | 3.98 | .00167 | 1.52 | - .31 | 69 | 22 | 15.66 | .90 |
| 12 | 5.13 | .00005 | 1.62 | - .31 | 61 | 29 | 21.03 | .84 |
| 13-23 | 37.59 | .00033 | 1.34 | - .21 | 67 | 30 | 58.99 | .87 |
| 24-27 | 34.79 | .00081 | 1.31 | - .20 | 67 | 38 | 33.73 | .87 |
| **PRAIRIE UNIT** | | | | | | | | |
| 1- 5 | 5.78 | 0.0012 | 1.39 | -0.40 | 80 | -- | -- | -- |
| 6 | 10.79 | .0036 | 1.30 | - .29 | 55 | 211 | 43.53 | 0.76 |
| 7 | 6.74 | .0261 | 1.27 | - .29 | 51 | 21 | 24.52 | .07 |
| 8 | 17.70 | .0002 | 1.39 | - .26 | 58 | 25 | 36.17 | .56 |
| 9 | 13.39 | .0005 | 1.39 | - .27 | 60 | 64 | 37.51 | .83 |
| 10 | 9.07 | .00009 | 1.57 | - .24 | 80 | 61 | 48.56 | .80 |
| 11-12 | 106.40 | .0014 | 1.17 | - .18 | 76 | 32 | 37.15 | .37 |
| 13-14 | 13.12 | .0051 | 1.18 | - .36 | 80 | 39 | 48.76 | .89 |
| 15-17 | -- | -- | -- | -- | -- | -- | -- | -- |
| 18 | 7.43 | .0000009 | 1.51 | - .37 | 71 | 21 | 21.24 | .90 |
| 19 | 135.82 | .0006 | 1.19 | - .21 | 76 | 29 | 67.10 | .97 |
| 20 | 35.11 | .0007 | 1.18 | - .35 | 82 | 43 | 77.98 | .87 |
| 21-23 | 10.09 | .0014 | 1.21 | - .41 | 82 | 23 | 38.08 | .96 |
| 24-25 | 3.95 | .0002 | 1.37 | - .48 | 70 | 36 | 30.24 | .55 |
| 26 | 12.59 | .0003 | 1.19 | - .49 | 75 | 29 | 65.95 | .78 |
| 27 | 4.32 | .0001 | 1.39 | - .43 | 71 | 22 | 61.52 | .43 |
| **RIVERBORDER AND BOTTOMLANDS UNITS** | | | | | | | | |
| 1- 3 | 10.55 | 0.00002 | 1.56 | -0.24 | 90 | 15 | 61.18 | 0.94 |
| 4 | 5.78 | .00116 | 1.39 | - .40 | 45 | 39 | 16.06 | .56 |
| 6 | 17.48 | .00573 | 1.32 | - .22 | 50 | 624 | 61.49 | .59 |
| 7 | 4.92 | .00122 | 1.28 | - .57 | 45 | 117 | 32.84 | .45 |
| 8 | 8.46 | .00004 | 1.36 | - .45 | 54 | 125 | 55.56 | .72 |
| 9-10 | 30.67 | .00267 | 1.24 | - .24 | 59 | 222 | 56.95 | .77 |
| 11 | 12.63 | .00096 | 1.32 | - .32 | 64 | 66 | 51.18 | .91 |
| 12 | 195.92 | .00044 | 1.20 | - .20 | 64 | 38 | 41.80 | .83 |
| 13-17 | 33.93 | .00249 | 1.22 | - .22 | 71 | 47 | 39.61 | .76 |
| 18 | 373.89 | .00012 | 1.18 | - .19 | 65 | 50 | 70.87 | .90 |
| 19 | 219.21 | .00015 | 1.15 | - .27 | 80 | 44 | 47.58 | .95 |
| 20-21 | 37.82 | .00083 | 1.26 | - .26 | 96 | 71 | 185.75 | .90 |
| 22-25 | 5.82 | .00300 | 1.35 | - .34 | 69 | 40 | 39.11 | .58 |
| 26 | 5.13 | .00095 | 1.39 | - .34 | 77 | 19 | 19.94 | .96 |
| 27 | 8.15 | .00003 | 1.34 | - .44 | 91 | 110 | 34.40 | .80 |

[1]Numbers in parentheses are the column numbers.

Table 5.--*Species and species group numbers for Missouri trees*

| Species or species group | Scientific name | Number |
|---|---|---|
| **Softwoods** | | |
| Shortleaf pine | *Pinus echinata* | 1 |
| Other yellow pines | *P. elliottii* | 2 |
| | *P. palustris* | |
| | *P. rigida* | |
| | *P. virginiana* | |
| Cypress | *Taxodium distichum* var. *distichum* | 3 |
| Eastern red cedar | *Juniperus virginiana* | 4 |
| All other softwoods | | 5 |
| **Hardwoods** | | |
| White oak A | *Quercus alba* | 6 |
| | *Q. macrocarpa* | |
| | *Q. michauxii* | |
| | *Q. muehlenbergii* | |
| | *Q. bicolor* | |
| | *Q. lyrata* | |
| White oak B | *Q. stellata* var. *stellata* | 7 |
| Red oak A | *Q. falcata* var. *pagodaefolia* | 8 |
| | *Q. rubra* | |
| | *Q. shumardii* | |
| Red oak B | *Q. coccinea* | 9 |
| | *Q. falcata* | |
| | *Q. veluntina* | |
| Red oak C | *Q. imbricaria* | 10 |
| | *Q. marilandica* | |
| | *Q. nigra* | |
| | *Q. nuttallii* | |
| | *Q. palustris* | |
| | *Q. phellos* | |
| Hickory A | *Carya illinoensis* | 11 |
| | *C. laciniosa* | |
| | *C. ovata* | |
| | *C. tomentosa* | |
| Hickory B | *C. aquatica* | 12 |
| | *C. cordiformis* | |
| | *C. glabra* | |
| | *C. texana* | |
| Hard maple | *Acer nigrum* | 13 |
| | *A. saccharinum* | |
| Soft maple | *A. rubrum* var. *rubrum* | 14 |
| | *A. saccharinum* | |
| Beech | *Fagus grandifolia* | 15 |
| Sweetgum | *Liquidambar styraciflua* | 16 |
| Tupelo and blackgum | *Nyssa aquatica* | 17 |
| | *N. sylvatica* var. *sylvatica* | |
| | *N. sylvatica* var. *biflora* | |
| Ash | *Fraxinus americana* | 18 |
| | *F. pennsylvanica* | |
| | *F. quadrangulata* | |
| Sycamore | *Platanus occidentalis* | 19 |
| Cottonwood | *Populus deltoides* | 20 |
| River birch | *Betula nigra* | 21 |
| Yellow-poplar | *Liriodendron tulipifera* | 22 |
| Basswood | *Tilia americana* | 23 |
| Black walnut | *Juglans nigra* | 24 |
| Black cherry | *Prunus serotina* | 25 |
| Elm | *Ulmus alata* | 26 |
| | *U. americana* | |
| | *U. rubra* | |
| | *U. thomasii* | |
| All other hardwoods | *Acer negundo* | 27 |
| | *Aesculus glabra* | |
| | *Betula papyrifera* var. *papyrifera* | |
| | *Catalpa speciosa* | |
| | *Celtis laevigata* | |
| | *C. occidentalis* | |
| | *Cornus florida* | |
| | *Diospyros virginiana* | |
| | *Gleditsia triacanthus* | |
| | *Gymnocladus dioicus* | |
| | *Juglans cinerea* | |
| | *Maclura pomifera* | |
| | *Magnolia acuminata* | |
| | *Morus rubra* | |
| | *Robinia pseudoacacia* | |
| | *Salix nigra* | |
| | *Sassafras albidum* | |
| Noncommercial hardwoods | | 28 |

Data collected on 13,136 trees in the State were used to develop these volume equations. Measurements taken were site index, tree class, d.b.h., merchantable height, and diameter of the stem at merchantable height. For sawtimber-size trees (9.0+ inches d.b.h. for softwoods, 11.0+ inches for hardwoods), measurements were taken at both the sawtimber and pulpwood limits of merchantability. The field crews also measured and estimated the volume of cull material (both in cubic feet and board feet) in each tree.

The net volume in these trees was then calculated using equations developed by Robert N. Stone[3] based on S. R. Gevorkiantz's "Composite Volume Tables for the Lake States."[4] Stone's equations compute gross volume in a tree from the three measurements--d.b.h., merchantable height, and diameter of the stem at merchantable height. This volume is then corrected for differences in bark thickness between species and the field estimate of cull volume is subtracted to arrive at net volume. If tree heights are tallied while making a local cruise, it would be advisable to measure bark thickness at the same time and to use either the tables from Gevorkiantz and Olsen (1955) or Stone's equations.

Experience in working with volume-d.b.h. relationships suggested that the best mathematical model for this type of data was the "Gomperz" function $Y = S \cdot B^{C^{D \cdot X}}$, where the dependent variable Y is tree net volume, the independent variable X is d.b.h., and the asymptote S is a function of site index ($S = A \cdot SI$). Work with test data and previous State surveys confirmed this belief and the model was used with the Missouri data.

The species groups used in the tables were primarily determined by number of observations available for a group (a minimum number of observations are necessary to form an equation using least-squares estimates) and similarity of bole form of the species within a group. The number of observations, the sampling error, and the $R^2$ for each regression estimate are shown in columns 7 through 9 (tables 1 to 4).

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[3] *Unpublished data on file at the North Central Forest Experiment Station, St. Paul, Minnesota.*

[4] *S. R. Gevorkiantz and L. R. Olsen. Composite volume tables for timber and their application in the Lake States. Lake States Tech. Bull. 1104, 51 p. 1955.*



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Plant a tree...trees give oxygen.